

**The Government of the Russian Federation  
Federal State Autonomous Institution for Higher Professional Education  
National Research University Higher School of Economics  
St. Petersburg Branch  
St. Petersburg School of Economics and Management**

**Course Syllabus**

**Financial Econometrics**

Area of Studies: 38.04.08 "Finance and Credit"

Level: Master

Master Programme "Finance"

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Recommended by the Head of the Students' Office for Master in Finance Master Programme  
Neklyudova M.A. \_\_\_\_\_ " \_\_\_\_ " \_\_\_\_\_ 20\_\_

Approved by the Academic Council of Master in Finance Master Programme  
On 30th August 2018 # 1-2018/19

Academic director: Rogova E.M. \_\_\_\_\_ " \_\_\_\_ " \_\_\_\_\_ 20\_\_

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## Course Syllabus

Title of the course	<b>Financial Econometrics</b>				
Title of the Academic Programme	Master's programme, "Finance"				
Type of the course	Elective				
Prerequisites	Basic knowledge of finance and statistics is a key prerequisite for the successful completion of the course. Also, a prior knowledge of any programming language is a plus.				
ECTS workload	3				
Total indicative study hours	Directed Study	Self-directed study	Total		
	42	110	152		
Course Overview	<p>The course is designed to introduce the various spectrum of quantitative financial econometrics. It discusses about some of the important contemporary statistical methods and its practical applications in the field of finance. The course starts with the basic concepts like random walk hypothesis and progresses towards the advanced topics like copula and wavelets.</p> <p>After mastering this course, the students will gain substantial knowledge about the financial econometrics and will be able to apply the same in solving real life problems in finance. Successful completion of the course will make them ready for the job market.</p>				
Intended Learning Outcomes (ILO)					
Teaching and Learning Methods	The course consists of lectures (20 academic hours = 10 80-minute long lectures) and of seminars (22 academic hours). The seminars will be primarily (though not exclusively) focused on demonstrating and practicing the use of all the concepts in E-views or/and R. Therefore, a useful by-product of the course will be an enhancement of the knowledge of E-views and R.				
<b>Content and Structure of the Course</b>					
№	Topic / Course Chapter	Total	Directed Study		Self-directed Study
			Lectures	Tutorials	
1	Scope and Methodology of Econometrics	12	2	2	8
2	Random Walk Hypothesis	12	2	2	8
3	Geometric Brownian Motion	4	1	1	2
4	Efficient Frontier	13	2	1	10
5	Portfolio Optimisation	13	2	1	10

6	Introduction to Asset Pricing Models	24	3	3	18
7	Risk Analysis	16	2	2	12
8	Introduction to Fat tails	16	2	2	12
9	Introduction to Copula Models	18	2	2	14
10	Introduction to Wavelets	16	2	2	12
11	Project Presentation	8		4	4
<b>Total study hours</b>		152	20	22	110

**Indicative Assessment Methods and Strategy**

Attendance in this course is compulsory as topics are inter-linked. It is expected that student will come prepared with at least few of the suggested reading before attending the classes. There will be one final exam, focused both on theory as well as practice, worth 50 % of the grade and 10 % for in-class participations/presentations. Rest 40 % will be devoted to the group project, in which students in couples will carry out an analysis of the data of their choice and provide a professional output of this analysis. The completed project report must be submitted along with presentation not later than one week before the end term examination.

<b>Readings / Indicative Learning Resources</b>	<b>Suggested Readings</b>	
	Scope and Methodology of Econometrics	Gujarati, D. N. (2009). <i>Basic econometrics</i> . Tata McGraw-Hill Education. (or higher version) Tsay, R. S. (2005). <i>Analysis of financial time series</i> (Vol. 543). John Wiley & Sons. E-Views resources - tutorial are available online can be accessed at <a href="http://www.eviews.com/Learning/">http://www.eviews.com/Learning/</a>
	Random Walk Hypothesis	Hall, R. E. (1987). Consumption. Fama, E. F. (1965). Random walks in stock market prices. <i>Financial analysts journal</i> , 55-59.
	Geometric Brownian Motion	Ross, Sheldon M. (2014). "Variations on Brownian Motion". <i>Introduction to Probability Models</i> (11th ed.). Amsterdam: Elsevier. pp. 612–14. ISBN 978-0-12-407948-9.
	Efficient Frontier	Markowitz, H. M. (1991). Foundations of portfolio theory. <i>The journal of finance</i> , 46(2), 469-477. Merton, R. C. (1972). An analytic derivation of the efficient portfolio frontier. <i>Journal of financial and quantitative analysis</i> , 7(4), 1851-1872.
	Portfolio Optimisation	Markowitz, H. (1952). Portfolio selection. <i>The journal of finance</i> , 7(1), 77-91. Merton, R. C. (1972). An analytic derivation of the efficient portfolio frontier. <i>Journal of financial and quantitative analysis</i> , 7(4), 1851-1872.
	Introduction to Asset Pricing Factor Models	Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk*. <i>The journal of finance</i> , 19(3), 425-442. Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. <i>The journal of Finance</i> , 25(2), 383-417. Fama, E. F. (1991). Efficient capital markets: II. <i>The</i>

	<p><i>journal of finance</i>, 46(5), 1575-1617.</p> <p>Fama, E. F., &amp; French, K. R. (2004). The capital asset pricing model: Theory and evidence. <i>Journal of economic perspectives</i>, 18(3), 25-46.</p> <p>Fama, E. F., &amp; French, K. R. (1993). Common risk factors in the returns on stocks and bonds. <i>Journal of financial economics</i>, 33(1), 3-56.</p> <p>Fama, E. F., &amp; French, K. R. (2015). A five-factor asset pricing model. <i>Journal of Financial Economics</i>, 116(1), 1-22.</p> <p>Ross, S. A. (1976). The arbitrage theory of capital asset pricing. <i>Journal of economic theory</i>, 13(3), 341-360.</p> <p>Maiti, M., &amp; Balakrishnan, A. (2018). Is human capital the sixth factor?. <i>Journal of Economic Studies</i>, 45(4), 710-737.</p>			
Risk Analysis	<p>Hamilton, J. D. (1994). <i>Time series analysis</i> (Vol. 2, pp. 690-696). Princeton, NJ: Princeton university press.</p> <p>Zhang, M. Y., Russell, J. R., &amp; Tsay, R. S. (2001). A nonlinear autoregressive conditional duration model with applications to financial transaction data. <i>Journal of Econometrics</i>, 104(1), 179-207.</p>			
Introduction to Fat tails	<p>Koenker, R., &amp; Bassett Jr, G. (1978). Regression quantiles. <i>Econometrica: journal of the Econometric Society</i>, 33-50.</p> <p>Engle, R. F., &amp; Manganelli, S. (1999). <i>CAViaR: conditional value at risk by quantile regression</i> (No. w7341). National bureau of economic research.</p> <p>Maiti, M. OLS Versus Quantile regression in extreme distributions. <i>Contaduría y Administración</i>.</p>			
Introduction to Copula Models	<p>Bouyé, E., Durrleman, V., Nikeghbali, A., Riboulet, G., &amp; Roncalli, T. (2000). Copulas for finance-a reading guide and some applications.</p> <p>Sklar, A. (1973). Random variables, joint distribution functions, and copulas. <i>Kybernetika</i>, 9(6), 449-460.</p>			
Introduction to Wavelets	<p>Vidakovic, B., &amp; Mueller, P. (1994). Wavelets for kids. <i>Instituto de Estadística, Universidad de Duke</i>.</p>			
Indicative Self- Study Strategies	<b>Type</b>		<b>+/-</b>	<b>Hours</b>
	Reading for seminars / tutorials (lecture materials, mandatory and optional resources)		+	30
	Assignments for seminars / tutorials / labs		+	30
	E-learning / distance learning (MOOC / LMS)		-	
	Fieldwork		-	
	Project work		+	30
	Other (please specify)		-	
	Preparation for the exam		+	20
Academic Support for the Course	Academic support for the course is provided via LMS, where students can find: guidelines and recommendations for doing the course; guidelines and recommendations for self-study; samples of assessment materials			
Facilities, Equipment and Software	E-Views 10 (Student Version) and R			
Course Instructor	Moinak Maiti, PhD, Associate Professor, Department of Finance			

### Intended Learning Outcomes (ILO) Delivering

Programme ILO(s)	Course ILO(s)	Teaching and Learning Methods for delivering ILO(s)	Indicative Assessment Methods of Delivered ILO(s)
LO2 Demonstrate deep knowledge and critical understanding of theories, principles, concepts and methodologies in finance	Knowledge of contemporary methods of econometric research and its appropriate applications.	Lectures Reading Exercises in the computer	Problems sets Empirical project Exam
LO3 Use strong analytical skills and apply them to solve practical problems	Will be able to critically analyze the given problem and to derive comprehensive solutions for the given problem.	Lectures Reading Exercises in the computer Empirical project	Problems sets Empirical project
LO6 Evaluate and Design financial strategies for companies and financial institutions in a turbulent environment	Identifying problem and need based appropriate solution modelling	Lectures Reading Exercises in the computer	Problems sets Empirical project
LO10 Demonstrate an innovative, open and ethical mindset	New Model development, and its applications to solve the problems in finance	Lectures Empirical project	Exam Empirical project

**Course Content**

1. Scope and Methodology of Econometrics
2. Random Walk Hypothesis  
    Random Walk Models
3. Geometric Brownian Motion
4. Efficient Frontier
5. Portfolio Optimisation
6. Introduction to Asset Pricing Factor Models  
    CAPM  
    Multifactor Asset Pricing Models
7. Risk Analysis  
    Volatility risk  
    ARCH & GARCH Models  
    Value at Risk Models
8. Introduction to Fat tails  
    Fat tails in financial data  
    How to handle fat tails  
    It's implication on investment decision
9. Introduction to Copula Models  
    Elliptical Copulas  
    Archimedean Copulas
10. Introduction to Wavelets  
    Multi scale Wavelet decomposition  
    Wavelet Covariance and Correlation  
    Wavelet Coherence  
    Wavelet Clustering

Project submission, presentation and End term Exam

## Assessment Methods and Criteria

## Assessment Methods

Types of Assessment	Forms of Assessment	Modules			
		1	2	3	4
Formative Assessment	Test				
	Essay				
	Report/Presentation				*
	Project				*
	In-class Participation				*
	Cases				*
Interim Assessment (if required)	Assignment (e.g. written assignment)				
Summative Assessment	Exam				*

## Assessment Criteria

### In-class Participation

Grades	Assessment Criteria
«Excellent» (8-10)	A critical analysis which demonstrates original thinking and shows strong evidence of preparatory research and broad background knowledge.
«Good» (6-7)	Shows strong evidence of preparatory research and broad background knowledge. Excellent oral expression.
«Satisfactory» (4-5)	Satisfactory overall, showing a fair knowledge of the topic, a reasonable standard of expression. Some hesitation in answering follow-up questions and/or gives incomplete or partly irrelevant answers.
«Fail» (0-3)	Limited evidence of relevant knowledge and an attempt to address the topic. Unable to offer relevant information or opinion in answer to follow-up questions.

### Project Work

Grades	Assessment Criteria
«Excellent» (8-10)	A well-structured, analytical presentation of project work. Shows strong evidence and broad background knowledge. In a group presentation all members contribute equally and each contribution builds on the previous one clearly; Answers to follow-up questions reveal a good range and depth of knowledge beyond that covered in the presentation and show confidence in discussion.
«Good» (6-7)	Clearly organized analysis, showing evidence of a good overall knowledge of the topic. The presenter of the project work highlights key points and responds to follow up questions appropriately. In group presentations there is evidence that the group has met to discuss the topic and is presenting the results of that discussion, in an order previously agreed.
«Satisfactory» (4-5)	Takes a very basic approach to the topic, using broadly appropriate material but lacking focus. The presentation of project work is largely unstructured, and some points are irrelevant to the topic. Knowledge of the topic is limited and there may be evidence of basic misunderstanding. In a group presentation, most of the work is done by one or two students and the individual contributions do not add up.
«Fail» (0-3)	Fails to demonstrate any appropriate knowledge.

### Written Assignments (Written & Practical Exam)

Grades	Assessment Criteria
«Excellent» (8-10)	Has a clear argument, which addresses the topic and responds effectively to all aspects of the task. Fully satisfies all the requirements of the task; rare minor errors occur;
«Good» (6-7)	Responds to most aspects of the topic with a clear, explicit argument. Covers the requirements of the task; may produce occasional errors.
«Satisfactory» (4-5)	Generally addresses the task; the format may be inappropriate in places; display little evidence of (depending on the assignment): independent thought and critical judgement include a partial superficial coverage of the key issues, lack critical analysis, may make frequent errors.
«Fail» (0-3)	Fails to demonstrate any appropriate knowledge.

## **Recommendations for students about organization of self-study**

Self-study is organized in order to:

- Systemize theoretical knowledge received at lectures;
- Extending theoretical knowledge;
- Learn how to use legal, regulatory, referential information and professional literature;
- Development of cognitive and soft skills: creativity and self-sufficiency;
- Enhancing critical thinking and personal development skills;
- Development of research skills;
- Obtaining skills of efficient independent professional activities.

Self-study, which is not included into a course syllabus, but aimed at extending knowledge about the subject, is up to the student's own initiative. A teacher recommends relevant resources for self-study, defines relevant methods for self-study and demonstrates students' past experiences. Tasks for self-study and its content can vary depending on individual characteristics of a student. Self-study can be arranged individually or in groups both offline and online depending on the objectives, topics and difficulty degree. Assessment of self-study is made in the framework of teaching load for seminars or tests.

In order to show the outcomes of self-study it is recommended:

- Make a plan for 3-5 presentation which will include topic, how the self-study was organized, main conclusions and suggestions and its rationale and importance.
- Supply the presentation with illustrations. It should be defined by an actual task of the teacher.

## **Recommendations for essay**

An essay is a written self-study on a topic offered by the teacher or by the student him/herself approved by teacher. The topic for essay includes development of skills for critical thinking and written argumentation of ideas. An essay should include clear statement of a research problem; include an analysis of the problem by using concepts and analytical tools within the subject that generalize the point of view of the author.

Essay structure:

1. *Introduction and formulation of a research question.*
2. *Body of the essay* and theoretical foundation of selected problem and argumentation of a research question.
3. *Conclusion* and argumentative summary about the research question and possibilities for further use or development.

## **Special conditions for organization of learning process for students with special needs**

The following types of comprehension of learning information (including e-learning and distance learning) can be offered to students with disabilities (by their written request) in accordance with their individual psychophysical characteristics:

- 1) *for persons with vision disorders:* a printed text in enlarged font; an electronic document; audios (transferring of learning materials into the audio); an individual advising with an assistance of a sign language interpreter; individual assignments and advising.
- 2) *for persons with hearing disorders:* a printed text; an electronic document; video materials with subtitles; an individual advising with an assistance of a sign language interpreter; individual assignments and advising.
- 3) *for persons with muscle-skeleton disorders:* a printed text; an electronic document; audios; individual assignments and advising.